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University-Associated SARS-CoV-2 Omicron BA.2 Infections, Maricopa County, Arizona, USA, 2022

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We investigated a university-affiliated cohort of SARS-CoV-2 Omicron BA.2 infections in Arizona, USA. Of 44 cases, 43 were among students; 26 persons were symptomatic, 8 sought medical care, but none were hospitalized. Most (55%) persons had completed a primary vaccine series; 8 received booster vaccines. BA.2 infection was mild in this young cohort.

In November 2021, cases of highly transmissible SARS-CoV-2 B.1.1.529 Omicron BA.1 variant were identified in southern Africa (*1*; F.P. Lyngse et al., unpub. data, https://doi.org/10.1101/2022.01.28.22270044). By January 2022, BA.1 was the dominant variant circulating globally, and the BA.2 variant had been detected in several countries, including the United States (*2*,*3*; F.P. Lyngse et al.). The BA.1 variant causes milder illness compared with the B.1.617.2 and AY (Delta) subvariants, especially in younger persons and vaccinated persons (*4*; J.A. Lewnard et al., unpub. data, https://doi.org/10.1101/2022.01.11.22269045), but clinical severity of BA.2 is not yet well described. We describe illness severity and clinical outcomes of a 44-person US university-affiliated cohort, comprised predominantly of students, who tested positive for BA.2.

On January 24, 2022, the Maricopa County Department of Public Health (MCDPH), Arizona, USA, was notified of a BA.2 cluster in persons at a university. Cases were identified through routine surveillance by the university-affiliated genomics laboratory (Appendix, https://wwwnc.cdc.gov/EID/article/28/7/22-0470-App1.pdf). MCDPH investigated to describe the epidemiologic and clinical outcomes of the cohort.

We defined a case as a university student or staff member with a SARS-CoV-2 PCR-positive

saliva specimen collected during January 3–23 that was tested in the university laboratory and identified as BA.2 by next-generation sequencing. MCDPH and the university distributed electronic questionnaires to all case-patients via text message, email, or both, which is county and university protocol for anyone with SARS-CoV-2 infection (Appendix). MCDPH investigators also conducted telephone interviews with case-patients to collect information on demographics, recent travel, clinical symptoms and outcomes, and vaccination history. We considered a case lost to follow-up if the person could not be contacted by telephone or refused the telephone interview and they did not respond to either electronic questionnaire. We supplemented race/ethnicity (when otherwise unknown), vaccination history, and university clinic visit data by using the Arizona State Immunization Information System and university records.

We defined illness onset as the first date a case-patient experienced any SARS-CoV-2 symptom or the specimen collection date if a person was asymptomatic or lost to follow-up. We categorized vaccination status as unknown or unvaccinated when no documentation of vaccination was available, or a case-patient reported being unvaccinated. We categorized status as completed a primary series when case-patients had documentation of receiving a Food and Drug Administration–authorized or approved vaccination series or a series listed for emergency use by the World Health Organization and considered case-patients boosted when they had documentation of an additional vaccine dose after completing a primary series. We considered a case previously infected if the patient had a SARS-CoV-2–positive PCR or antigen test collected >90 days before BA.2 illness onset in the statewide communicable disease database.

We identified 44 cases, 43 (98%) were in students, which accounted for <1% of 6,268 university-affiliated persons who tested SARS-CoV-2–positive during the study period (*5*). Case-response rate to either questionnaire was 75%. Median age among case-patients was 21 (interquartile range 19–24) years; 29 (66%) were male; 12 (27%) identified as Asian/non-Hispanic, 3 (7%) as White/non-Hispanic, and 29 (66%) as other or unknown race/ethnicity.

At least 26 (59%) case-patients experienced ≥1 symptom, most of which were consistent with a viral upper respiratory tract infection, such as sore throat, rhinorrhea and cold-like symptoms, cough, and fever (Table). Only 8 (18%) case-patients sought medical attention from the university clinic ≤7 days before or after their BA.2-positive specimen collection date, but none were hospitalized, and none died.

Of 44 cases, 24 (55%) completed only the primary vaccine series, 8 (18%) received booster vaccines, 12 (27%) had an unknown or unvaccinated status, and 1 (2%) was previously infected with SARS-CoV-2. Of 32 case-patients who completed a primary series, 16 (50%) received an mRNA vaccine, either Comirnaty (Pfizer-BioNTech, https://www.pfizer.com) or

Table. Characteristics of SARS-CoV-2 B.1.1.529 Omicron BA.2 cases among students and staff affiliated with a local university, Maricopa County, Arizona, USA, January 2022*

Characteristics	No. (%)
Median age, y (IQR)	21 (19–24)
Sex	
M	29 (66)
F	15 (34)
Race and ethnicity	
Asian, non-Hispanic	12 (27)
White, non-Hispanic	3 (7)
Other/unknown	29 (66)
University affiliation	
Student	43 (98)
Staff	1 (2)
Case interview response type	
Telephone interview and electronic survey	20 (45)
Electronic survey only	13 (30)
Lost to follow-up	11 (25)
University clinic visit ≤7 d of illness onset†	
Y	8 (18)
N	36 (82)
Symptom status	
No symptoms	8 (18)
Unknown	10 (23)
Any COVID-19 symptom	26 (59)
Sore throat	18 (41)
Cough	16 (36)
Runny nose, cold-like symptoms	16 (36)
Fever	15 (34)
Muscle aches	11 (25)
Fatigue	10 (23)
Chills	4 (9)
Headache	4 (9)
Shortness of breath	2 (5)
Difficulty breathing	2 (5)
New loss of taste or smell	2 (5)
Diarrhea	2 (5)
Vomiting	1 (2)
Outcome	
Hospitalized	0
Died	0
COVID-19 vaccination status	
Primary series completed, not boosted	24 (55)
mRNA, Pfizer or Moderna	16 (50)
Janssen/Johnson & Johnson	5 (16)
Vaxzevria, Oxford-AstraZeneca	11 (34)
Primary series and booster completed	8 (18)
Unknown or unvaccinated	12 (27)
Median days from primary vaccination series completion to illness onset (IQR)‡	216 (164–269)
Median days from booster vaccine dose to illness onset (IQR)	27 (19–42)

*Illness onset is defined as the first day of symptom onset or the day of positive specimen collection (if asymptomatic or lost to follow-up). IQR, interquartile range.
†Within 7 days before or 7 days after illness onset.
‡Excludes case-patients who received a booster dose of COVID-19 vaccine (n = 8).

Spikevax (Moderna, https://www.moderna.com), 11 (34%) received Vaxzevria (Oxford-AstraZeneca, https://www.astrazeneca.com), and 5 (16%) received Janssen/Johnson & Johnson (https://www.jnj.com).

The mild illness and outcomes we describe might have been driven by the cohort's age rather than viral characteristics. Because our study involves a univwersity-affiliated cohort, these findings might not be generalizable to more diverse populations. Also, the low telephone interview participation rate prevented collection of close contact information to assess transmission dynamics. In addition, a potential unknown bias in random specimen selection for sequencing could limit the ability to generalize outcomes to this population.

In conclusion, >50% of 44 case-patients in our cohort experienced symptomatic BA.2 infection, but <25% sought medical care, suggesting BA.2 infection in a young population might be mild. In addition, nearly 75% of case-patients completed a primary vaccination series which, in addition to their age, might have contributed to their mild illness. However, data were insufficient to compare if vaccination status affected whether case-patients experienced symptoms or sought medical care. Among persons who completed a primary vaccine series, only 25% received booster vaccines. By March 2022, in alignment with Centers for Disease Control and Prevention recommendations (*6*), >33% of Maricopa County residents ≥18 years of age had received a booster dose. However, targeted efforts might be needed to encourage booster vaccines among university students (*7*).

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University-Associated SARS-CoV-2 Omicron BA.2 Infections, Arizona, USA, 2022

Appendix

University-Based SARS-CoV-2 Testing

The university has a robust and accessible SARS-CoV-2 testing program in which students and staff are offered testing at any time, regardless of whether they are symptomatic. Students and staff can seek testing without healthcare provider orders. Specimens can be collected by a healthcare provider at multiple campus locations or self-collected specimens can be deposited at multiple easily accessible "drop-off" points. The impetus for testing varies by individual but, anecdotally, is due to the person recently traveling, being symptomatic, or having been notified of exposure.

University PCR testing utilizes the TaqPath COVID-19 Fast PCR Combo Kit 2.0 (Applied Biosystems/Thermo Fisher Scientific, https://www.thermofisher.com) clinical laboratory assay. As part of a baseline genomic surveillance program, specimens were randomly selected for next-generation sequencing (COVIDSeq; Illumina, https://www.illumina.com) from all university-tested PCR-positive specimens. All specimens sequenced as Omicron BA.2 (Pangolin v1.2.124) during the study period were included in this cohort.

The selection of samples to sequence was not biased by any targeted sampling effort. Due to limitations that the Omicron surge provided, not all PCR-positive specimens could be sequenced in real time; however, during the study period, over 40% of all specimens were selected for sequencing. In addition to BA.2, sequences for other variants (such as Delta and BA.1) were also detected in the randomly sequenced specimens within this population during this time.

Electronic Questionnaires

Maricopa County Department of Public Health (MCDPH) electronic questionnaires are sent via text message to all Maricopa County residents with cases of SARS-CoV-2 infection (based on a positive PCR or antigen test) that are reported to the health department with a telephone number. Requested case information in the MCDPH electronic questionnaire includes demographics and living situation (gender, race, and ethnicity; living situation; workplace type); medical comorbidities and COVID-19 vaccination status; illness onset and severity (date of illness onset, if symptomatic; symptoms experienced; whether they required hospitalization or mechanical ventilation); and infection risk factors (prior known contact with someone with SARS-CoV-2 infection; recent travel).

In addition to the MCDPH electronic questionnaire sent to all Maricopa County residents, the university sends a similar electronic questionnaire to university students and staff with SARS-CoV-2 cases. Questions are similar to those in the MCDPH questionnaire, but do not include information about case race/ethnicity, hospitalization status, or workplace type.

Per MCDPH COVID-19 investigations protocol, if a case-patient responded to the MCDPH electronic questionnaire and did not indicate that they live or work in a high-risk or congregate setting (e.g., long-term care facility, correctional facility, etc.), MCDPH and partner investigators would not attempt a telephone interview with the case-patient. In this investigation, MCDPH investigators attempted to contact each university student or staff member with a case of BA.2 infection regardless of whether they responded to the electronic questionnaire. Questions in the telephone interview did not deviate from those in the questionnaire, but phone interviews might have enabled more complete data collection in the case of a person who both responded to the questionnaire and the telephone interview.

Cohort Travel and Previous International Residence

Forty-three cases (98% of total) were identified in university students, of which 10 (23%) reported domestic or international travel, or both, in the 14 days before illness onset. Of those who traveled, 8 (80%) traveled internationally and 7 (70%) reported travel to the same country. Median time from travel return to illness onset was 3 (IQR 3–10) days. Additionally, of student

cases, 36 (84%) resided internationally before enrolling at the university. Of those, 33 (92%) resided in the same country (Appendix Table).

Students who previously traveled or resided internationally accounted for >80% of the cohort, many of whom reported international travel during their exposure period. Travel to countries where Omicron BA.2 subvariant was circulating could explain the association of Omicron BA.2 subvariant infection within this subpopulation. Among those who traveled, infection likely occurred during travel, given median illness onset of 3 days post-travel, which aligns with the Omicron variant incubation period. The high proportion of case-patients reporting travel might be due to increased travel related to Winter holidays. Additionally, most cases occurred in students who previously traveled to or resided in the same international country, which may have increased the likelihood of transmission among shared social contacts.

Appendix Table. Previous international residency status and travel characteristics of SARS-CoV-2 Omicron (B.1.1.529) BA.2–infected students and staff affiliated with a local university, Maricopa County, Arizona, USA, January 2022

Characteristics	No. (%)
University affiliation and previous international residency status	
Student	43 (98)
Previously resided internationally	36 (84)
Previously resided in the country of travel	33 (92)
Travel during 14-d exposure period	
Domestic	2 (5)
International	8 (18)